CHESAPEAKE BIOLOGICAL LABORATORY

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R. V. TRUITT

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ANNUAL REPORT

DEPARTMENT OF RESEARCH AND EDUCATION

A—GENERAL

This Department of the Board of Natural Resources is administered by the Commission of Research and Education whose members are: Dr. B. H. Willier, Head, Department of Biology, The Johns Hopkins University, *Chairman;* Mr. H. R. Bassett, Seafood Operator, Crisfield; Dr. Lloyd M. Bertholf, Dean, Western Maryland College, Westminster; Dr. Ernest N. Cory, State Entomologist, University of Maryland, College Park; and Professor Franklin D. Day, Superintendent of Schools, Queen Anne's County, Centreville, *Secretary.* The members of the Commission are appointed by the Governor for staggered, five-year terms to insure continuous and effective policies. The work of the Department falls into three major field of interest, research, education and weather service. The headquarters of the Department are located in its subsidiary agency, the Chesapeake Biological Laboratory at Solomons Island. According to the Act creating the present conservation agencies, the Department is in charge of the research and the educational activities for the entire field of conservation administered by the Board of Natural Resources.

The work of the Department during the year is reported herein according to major activities.

B—EDUCATION

The step-by-step development of the educational program of the Department has been set forth in previous reports. The immediate purpose of this work is to arouse public interest in the preservation and development of our natural resources which form the basis of the State's wealth and the foundation of individual and national security. The Department's investigations, and the experience of several administrative agencies indicate many glaring examples of poor conservation, or of no conservation interest whatsoever. Also, they afford examples of marked steps forward in Maryland conservation. These were used as illustrative and demonstrative examples in the several classes and short courses which were scheduled during the year. All students registered in the program were conducted on field studies by specialists on soils, water, forests, game, fisheries and related work where first-hand observa-

tions were made. Publications, pictures, and lectures in formal classroom work rounded out the class programs.

Classes for in-service teachers were offered through the cooperation of the College of Education, University of Maryland, in which, in the fall term, a session was held in Calvert County and, in the spring, at Solomons, Crisfield, and College Park. Seventy teachers were enrolled. In addition, laboratory and field trips were conducted in the Department's program for students registered for conservation work at the State Teachers' Colleges, in the Work Shop groups at Frostburg, Towson and College Park, and in the Summer School at the University. The in-service and pre-service teachers' course, a total of four classes, carried credit of three semester hours at the advanced undergraduate and graduate level. Considerable assistance was given in the development of a strong conservation credit course at Washington College.

Short, more intense courses were provided for special groups during the year, including a three-day lecture and demonstration session for the County Superintendents of the State, practically all of whom with their administrative officials were in attendance. Members of the Staff participated actively in the Maryland Department of Education's program of "Curriculum Development and Planning in Conservation Education" in which effort is being made to determine the proper level or levels for the introduction of conservation education into the school curriculum in the new program brought about by the recent addition of a full year to the public school schedule. Also, members took part in scientific and educational meetings and participated in conservation programs of clubs, officer training sessions, a 4-H program and those of many civic and service organizations, some sixty of the last named.

Requests for conservation information and for published material mounted during the year and were met as far as possible by the Staff. Because of the aroused student interest, brought about by the teacher training program being reflected into the class room, requests for information and publications for the grade schools reached a point where available time and published material could be given only to the teachers involved. During the year, four publications were issued, in addition to material made available to the public press, and the informational monthly journal, *Tidewater News*, with a circulation of 5,000 copies.

C—INVESTIGATION

1. OYSTERS

Oyster investigations have continued to be centered around the accumulation of factual information essential to successful management of the industry, although problems in pure science are also being pursued. Emphasis during the year was placed on: (1) popula-

tion studies of oyster bars, (2) intensity of spat fall, (3) fouling of cultch, (4) growth and mortality in seed areas and among transplanted oysters, (5) distribution of oyster enemies, (6) extent of natural mortalities and their relation to salinity changes, and (7) condition or fatness of oyster meats at different seasons and upon diverse bars.

Reports have been made to administrative agencies containing data on the commercial spat fall on State shell plantings, the growth and mortality of seed planted on reserve areas, the time of setting of major fouling organisms, tne extent of mortality caused by the oyster drill in Tangier Sound, the composition of representative oyster bars, and a review of past and present conditions in the Chesapeake Bay dredging areas. Field data sheets were devised, together with permanent file sheets, upon which the extensive data accumulated from individual bars are summarized and made available for reference purposes.

Extensive data on stream flow from the Susquehanna River and from salinity conditions in Chesapeake Bay have been further augmented and analyzed. These data show a definite correlation with the condition of oysters and their survival in the upper portions of the Bay. A preliminary paper on these findings was presented to the 1946 meeting of the National Shellfisheries Association in conjunction with a report of the Fish and Wildlife Service on the condition of the bars of the upper Bay (Published separately.) Cooperative work with the U. S. Fish and Wildlife Service is resulting in a much more extensive coverage of information on oyster conditions in the Chesapeake area than has hitherto been available for administrative use, this affording a sounder basis for the formulation of future management policies.

Hydrographic data accumulated during 1945-46 were marked by the occurrence of the longest sustained period of low salinities during the eight and a half years of record at the Laboratory. The low salinities, as in previous years, correlated closely with high run-off from the Susquehanna River. Data further indicated that, during most periods of high run-off from the Susquehanna, more marked salinity depressions occur in the Bay at the mouth of major down-bay estuarine tributaries than occur further upstream in the tributaries themselves. The short interval, about six days, elapsing between the onset of flood waters at Conowingo and the resultant salinity drop at Solomons, indicates that normal salt water down the Bay is rather rapidly displaced by fresher water masses from the upper reaches. The downstream tidal gradient of the Bay and of the tributaries serves to hinder the entrance of these fresher waters for any great distance into the tributary streams. Partial return to normal salinities is rapid but remains incomplete for a much longer period of time than that of the initial drop. Again, the return of

more saline waters from the lower Bay is aided by a lesser upstream gradient than is present during the downstream transport of flood waters.

Severe oyster losses occurred during the Winter and early spring of 1946 on the upper Bay bars and, in decreasing amounts, abnormal mortalities extended down the Bay as far as the Patuxent River on the Western Shore. Oysters in the tributary waters of the Eastern Shore from the Choptank River down remained in good condition. Planters in Chincoteague Bay, however, experienced heavy oyster losses and poor growth, apparently the result of smothering by algae and a decreased salinity following the heavy local rainfall of June and July of 1945.

Test bags of clean shells were exposed periodically at a number of stations to determine the season and intensity of setting of oyster spat and of fouling organisms on various bars, and to indicate the comparative efficiency of clutch planted at different seasons. An exceptionally heavy set of oyster spat occurred during 1945 in St. Mary's River. Good sets also occurred in Tangier Sound and most of the other Eastern Shore tributaries. Light sets were general in the Solomons area. Oyster drill activity in the Tangier Area was reduced almost to zero as a result of the low salinity prevailing during the latter half of 1945. This permitted an excellent survival of spat, a condition in marked contrast to that of previous years. Prospects for future commercial production in that area appear good provided the oyster drill is kept in check.

Experiments on the effect of underwater explosions upon oysters were continued during the fall. Data from same are to be made a part of a report on the general effect of explosions on economic marine forms. It was found that a few oysters at times were killed or injured within a maximum radius of 200 feet from 300 pound charges. Within this radius the position of the oyster bill's opening with reference to direction of the pressure wave seems to offer the best explanation for the sporadic losses observed. Most oysters, even when placed 15-25 feet from the charge, survived the explosions. No apparent damage occurred to native oysters dredged within a few hundred feet of the scene of the repeated explosions. Further observations are needed to establish the relationship of relative position to subsequent injury.

2. CRABS

The violent fluctuation in supply continues as the most important problem confronting blue crab research in the Chesapeake Bay. These investigations, therefore, centered around accurate determination of the extent of these changes and of their causes. The records thus far accumulated do not show a consistent relationship between the number of crabs producing eggs on the spawning grounds and the number of mature crabs produced. This Department, however,

has strongly urged that a plentiful supply of spawning crabs be maintained in the area most favorable to reproduction, if only to serve as insurance against the worst effects of other factors. It is hoped that other controlling factors may be isolated in the near future. In the meantime, the protection afforded by such aids as the Virginia sanctuary adds to the spawning stock at a low commercial cost.

Weekly analyses of the crabs available at Rock Hall, Tilghmans, Secretary and Toddville were made along with the collection of temperature, salinity and other data. These counts were made by trusted commercial crabbers and checked by the Staff. They have shown major changes in the kinds of crabs present in these areas by size and by sex. These records, together with average daily catch figures obtained from the local crab houses, provide a basis for close estimation of the relative number of crabs of any size present at any one time. Such data yield accurate knowledge of abundance and migration not heretofore available. Also, they may become important contributions in the effort to achieve optimum crab production in the Bay.

The studies of the anatomy of the male and female reproductive systems of this species were completed during the year. Crabs are highly specialized crustaceans and have a complex system for producing young. Each male produces almost inestimable number of sperm cells, far more than can be utilized by the females with which he mates. Females also develop more germ cells (eggs) than the approximately three million they extrude and hatch. Each adult animal has great "reproductive capacity" but the baby crabs have so many enemies that billions of young must be hatched if millions of adults are to reach the industry.

The tagging and release of crabs during the year continued in order to gather further information as to their migration, survival, age and related factors. Much information is in hand from these studies, but there are certain blanks in the information regarding the movements of crabs which require attention. All of the tagging results accumulated since 1924 are being summarized in order that these blanks can be filled in as far as possible and the entire story of crab movement examined and analyzed.

Other technical studies have been continued. The killing effect of underwater explosions has been examined further, and it is apparent that damage is not serious except in the immediate vicinity of a fairly heavy charge. Mud crabs from many oyster bars have been collected and will be identified and charted according to their distribution. The determination of the effect of DDT on this form is planned. The winter distribution study of crabs was temporarily omitted from the program because of fund shortages resulting from certain necessary emergency State action. It is anticipated that this feature of the program will be renewed in future years.

No accurate Bay-wide records exist on the catch of crabs. The Department of Tidewater Fisheries has been receiving valuable monthly estimates from packers, and the Fish and Wildlife Service collects approximations of annual production in Virginia, but these are far from adequate for a detailed study of changes in supply. A new method for daily records of crab capture is needed by the industry, administrators and scientists in both states. Such a method is being developed at present and will be put into practice as soon as possible in order to assure dependable records for future use.

3. FISH

The collection, tabulation and analysis of daily catch records from all licensed fishermen in the State, together with seasonal records from a number of unlicensed men, became the responsibility of this Department in 1944. This work has developed satisfactorily and with promising results. A 94% coverage of licensed fishing was obtained through correspondence and personal visits and without the policing of delinquent records. The data accumulated in 1945 made possible the first comparative analysis since the survey of the fishing industry was initiated. All records prior to 1944, most of which were collected by the former U. S. Bureau of Fisheries, were obtained on the basis of annual estimates, and while indicative of general trends, they did not offer the detailed and accurate information necessary to the sound administration of the current fishery conservation program in Maryland.

The present statistical system indicates not only major fluctuations in the total fishery, but indicates the fluctuations of individual species within the various fishing areas, and also the effect of different types and amounts of fishing gear on these species. The analyses of 1945 do not give indication of an increase or restoration of the Chesapeake fisheries. With the exception of two ocean-spawning species, trout and spot, all major species have shown decreases. Rock, shad, herring, croaker, and white perch have shown marked declines from the 1944 level, a trend that has been felt to some degree in the major fisheries of the United States generally.

In contrast to the Chesapeake catch, the landings of the rapidly growing ocean fishery centered at Ocean City increased more than three times in volume, and promise nearly to equal the Chesapeake landings during the year ahead. This fishery is supported in part by ocean pound nets, but the great increase was due to the influx of out-of-State otter trawl boats, in addition to seine and hand-line vessels.

The commercial fish hatcheries were operated during the 1946 season on a scale reduced from that of previous years in accordance with findings and recommendations announced in the 1944-45 biennial hatchery report. Yellow perch hatching was carried on at the box-system station on the breeding grounds of Severn Run, and

Fig. 4. Two views of the yellow perch hatchery on the upper Severn River. Photo by the Department of Tidewater Fisheries.

the resultant fry were released in suitable streams of all the tidewater counties. The shad hatchery effort in 1946 was limited largely to a biological test (using the box-system) of the waters of the North East River at Charlestown to determine the suitability of that region as a source of water for the hatching of shad in the event that it becomes feasible to erect and install a permanent jar-system hatchery at the head of the Bay. Results indicate that the waters of the North East River, at the point tested, are of good quality for the hatching of shad. Other shad hatching activities comprised a continuation of cooperative operations with the U. S. Fish and Wildlife Service hatchery unit on the Potomac River.

An investigation into the food habits of the largemouth black bass was initiated with the aim of determining the effect of the food consumption of this species on the annual crop of young shad and rock.

A biological and chemical survey is in progress to ascertain the relative value of Back River as a nursery area for fish. The possibility of restocking this body of water has been a point of considerable interest to sportsmen and commercial fishermen in the upper Bay region.

The periodic collection of scales from commercial catches of rock was continued during the year. The 1942 and 1943 broods of rock comprised the greater portion of the catches sampled, with only a small contribution from older broods. Yearling fish of the 1944 brood were not abundant, but there was indication that the 1945 brood, although relatively small, would add materially to the catch in 1947 and 1948.

Sampling for juvenile fish with a small-mesh haul seine was conducted at established stations in the major spawning areas, and with the exception of the Patuxent River, gave no indication of an unusually large brood of rock for the 1945 season. Young spot were not so abundant in the 1945 sample as in those made in 1944, and there was no indication of an expected increase in the spot population for 1946 or 1947.

Extensive shad scale collections were made in the course of hatchery operations at the head of the Bay and at the station on the Potomac River. These samples, together with collections made for the Department by officers of the Department of Tidewater Fisheries, were forwarded to the Fish and Wildlife Service Laboratory, as part of a cooperative study being conducted on the shad populations of the Chesapeake area. Another feature of the cooperative shad study was the collection of plankton samples from the Patuxent River during the spring of 1946 in an effort to determine the success of spawning of the shad population of that area.

The value of the present fifteen pound limit on the capture of rock in Maryland waters has been the subject of considerable dis-

cussion among fishermen and conservationists for a long period. A study was reinitiated in 1945 looking toward the evaluation of this law. Length and weight measurements, scale samples and ovaries were collected for analyses from large rock, particularly those in excess of fifteen pounds. The study was continued in 1946, in which additional samples were obtained from the spawning areas of the Upper Bay. Data from these sources are to be studied to determine the relative efficiency of the large and small fish in spawning.

4. DIATOMS

The continuing study of diatoms was furthered during the year by extended collecting and analysis of these microscopic plant forms so important as oyster food. Fluctuations in species and in numbers of these organisms are recorded which, together with hudrographic records, eventually may throw light on certain biological problems of significance, especially that of the oyster.

5. HYDROGRAPHY AND POLLUTION

It was not possible to re-establish the full hydrographic program during the year due to the lack of an adequate boat and to the impossibility of securing a specialist to replace a pre-war worker. However, the pier hydrographic station at the Laboratory was operated, periodic sampling was done for surface and bottom oxygen, salinities, temperature and biotic conditions at the Sandy Point location. Elsewhere on the Patuxent River some activity was carried on in order that long continued records should not be broken.

A number of requests that observations be made on public waters suspected of pollution were honored through chemical and biological analyses by Staff members. Routine sampling, in partial resumption of a pre-war program, of the stations in the Patapsco estuary was made fortnightly throughout the year. Contrary to general understanding, there was indication of increased acidity of the Patapsco waters following the wartime slowdown of industry.

6. UNDERWATER EXPLOSIONS

Effort to determine the nature and extent of injury, if any, on commercial forms caused by underwater explosives was renewed, being largely a warm weather project due to the migratory habits of the fish. Further data were obtained on the lethal range, impact effects and the nature of the injury caused by explosives of different types and sizes at established distances. A number of improvements was made in the experimental techniques and very excellent data were obtained from this project through the continued cooperation of the U. S. Naval Mine Warfare Test Station.

D—WEATHER SERVICE

The work of the U. S. Weather Service is conducted in Maryland on a cooperative basis through this Department. The program is a

long range continuing one in which data are collected at seventy-odd stations strategically located State-wide. These stations consist of wooden sheds developed through study and experience of the U. S. Weather Service, in which is housed the recording equipment, except for metal rain gauges located in the immediate area. Temperature, degree of clearness, air movement, precipitation records and all unusual weather developments, are recorded daily from these facilities and filed with the central office, U. S. Custom House, Baltimore, for recording, interpretation and forcasting purposes. All observations are made voluntarily and without pay for services.

While the present weather program is productive of fine services to the general public, and to shipping and air interests, especially as related to forecasting, it has not been possible to date to render essential detailed information to smaller areas, such as the fruit producing regions, due to the insufficiency of local stations to provide records. However, in overall aspect, the records of about three-quarters of a century indicate that the State has a fine advantage in its climatological factors of sunshine, temperature, wind, precipitation, and relative freedom from catastrophic changes in the weather.

E—ACKNOWLEDGMENTS

Much of the work of the Department is of a cooperative nature in which several institutions and agencies of the State and the Federal Government participate. State Superintendent of Public Education, Dr. Thomas Pullen, and the County Superintendents, together with their administrative associates gave support and impetus to the conservation education program to have it reach far into the school system. The College of Education, University of Maryland, offered academic credit as well as much encouragement to the in-service teacher program. The City of Baltimore, through the Harbor Engineer's Office, provided men and facilities for pollution sampling in the Patapsco estuary, as did the Department of Tidewater Fisheries for many marine sampling expeditions. The local Naval Mine Warfare Test Station made possible the series of observations on detonation effects on commercial fishes, while the U. S. Maritime Commission supported a comprehensive series of tests on anti-fouling paint in which the Pier facilities were used.

The U. S. Fish and Wildlife Service cooperated extensively with the Department in oyster research projects. In fact, the Service maintained a temporary station manned by a personnel of two or three workers at Annapolis, and the oyster program of the upper regions of the Bay was taken over entirely and effectively by that agency, while it gave considerable help elsewhere in this State-wide study. The Fish and Wildlife Service also acted as coordinator for the crab investigations in the Chesapeake Bay and itself carried the burden of establishing an index of soft crab abundance in Tangier

Sound. Shad fry produced on the Potomac River were the result of a cooperative project, while materials, facilities, field efforts and the shad researches in general, were pooled with the Service to step up the quantity and quality of the work.

The different Departments of the Board of Natural Resources cooperated in the issuance of educational material and especially in that feature of the program dealing with conservation education, in which time was freely given by the various specialists to class room assignments. The Commission of Research and Education wishes not only cordially to thank the agencies, institutions and individuals who cooperated with and participated in the Department's several programs, but to express deep appreciation of the valuable services rendered.